Technical Bulletin

Calibration Verification of Digital Refractometers

To check the accuracy of an instrument by using a certified calibration oil (such as Reichert Part Number 13K41330) follow these steps:

1. Take a reading of the **refractive index** of the standard on the refractometer (not Temperature Compensated !), taking note of the result as well as the temperature. *The reason for using the non-temperature compensated mode for taking this reading is that most instruments use a sucrose temperature coefficient for temperature corrected readings. Since this is not a sucrose solution, this would be inappropriate.*
2. Take note of the **Reference Temperature, Refractive Index, and Temperature Coefficient** of the oil being used from the label on the bottle. *Example: Reichert part number 13K41330 Certified Calibration Oil typically has a Reference Temperature of 25°C, a Refractive Index of 1.51416 nD, and a Temperature Coefficient of approximately –0.000412. Temperature coefficients are almost always negative numbers (refractive index decreases as temperature increases) and typically from –0.0003 to –0.0004 for oils, and –0.0001 to –0.0002 for water based solutions (aqueous).*
3. Subtract the temperature of the actual reading from the reference temperature of the certified oil to obtain the **Temperature Differential**.
4. Multiply the result from #3 by the **temperature coefficient** of the certified oil to obtain the **Temperature Compensation Factor**. *(Note: If you do not know the temperature coefficient of your sample, it can be determined experimentally by reading the refractive index of the sample at two temperatures, then calculating the change in refractive index per change in temperature: $\Delta RI/\Delta T$. As mentioned previously, temperature coefficients are almost always negative numbers and are typically from –0.0001 to –0.0004.)*
5. Add the result from #4 to the **actual refractive index** reading to obtain the **Temperature Corrected Refractive Index**.
6. Compare the result from #5 to the Refractive Index as labeled on the certified oil.

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Formula:

RITC = ((RT-AT)*TC)+RI

RITC = Refractive Index Temperature Corrected

RT = Reference Temperature As Stated on NIST Certificate or Oil Label

AT = Actual Temperature Refractive Index Of Sample Is Read At On Refractometer

TC = Temperature Coefficient Of Oil as Stated on NIST Certificate or Oil Label

RI = Actual Refractive Index As Read On Refractometer

Example:

1. A certified calibration oil is read on an automatic refractometer as having a refractive index of 1.51519 at 22.48°C.
2. The actual value of the oil as certified by N.I.S.T. is R.I. = 1.51416, Reference Temperature = 25°C, Temperature Coefficient = -0.000412 dn/dt.
3. Temperature Differential = Reference Temp. - Actual Reading Temperature = 25.00 - 22.48 = 2.52
4. Temperature Compensation Factor = Temperature Differential times Temperature Coefficient = (2.52) x (-0.000412) = -0.00103824
5. -0.00103824 + 1.51519 = 1.51415176 (This would be the temperature corrected refractive index at 25°C

If the value obtained above differs from the known value of the calibration standard by more than the accuracy tolerance for the instrument, calibration of the instrument is necessary as described in the instruction manual. NIST oils may be substituted for any calibration points on Reichert refractometers, including the Test Glass used on the ABBE MARK II.

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